Human Wastes and the Chesapeake Bay

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ABSTRACT

The Chesapeake Bay is generally considered to be a healthy body of water, but its future quality is in jeopardy so long as major tributaries remain polluted. Past pollution abatement actions, and most current ones, were directed toward removing oxygen-consuming substances, solids, and microorganisms. New plant designs provide greatly increased removal efficiencies. Such increased efficiency is essential if present pollution levels are to be reduced as projected population growth takes place. In addition, nutrient reductions will become increasingly important. With improved treatment of sewage and industrial wastes, the effects of urban and rural runoff and sedimentation will become more important. Already silt is the most important pollutant in some streams and urban and rural runoff will become the limiting factors in water quality when adequate control of point sources has been achieved.

In geologic terms, the Chesapeake Bay is young. Early man may have witnessed the formation of at least parts of it. Some fear has been expressed that contemporary man may witness its destruction. And, of course, the same geologic and climatic forces that created the Bay a few thousand years ago will ultimately submerge the Bay under the ocean or convert it to dry land. Our narrow perception of time permits us to view such a future catastrophe with equanimity. The "Save the Bay" bumper stickers that were popular at one time were not a plea to prevent further fluctuations of the ocean level or to legislate against orogeny. They reflected a much more practical concern that *man's uses* of the Bay are being threatened.

What we are concerned about, then, is not the threat to the Bay, but the threat to the Bay's utility. What profits it a man to save the Bay if he cannot swim, sail, or fish it? This egocentric view, while it may not sound noble, is appropriate since the principal threat to man's use of the Bay is man's use of the Bay. To be more accurate, the principal threat is man's unwise use of the Bay.

It is important but not always easy to distinguish between wise and unwise uses, and between beneficial and harmful uses. In fact, the same use can be both wise and unwise, both beneficial and harmful depending upon such variables as time, location, and one's attitude. Some uses of the Bay are not even recognized as such by the user. The contractor or farmer who does not guard against erosion is using the Bay as a sediment trap. The community or industry which discharges liquid wastes is using the Bay as a waste transportation and treatment device.

Such uses are, in one sense, extensions of natural processes which occurred before man arrived on the scene. Erosion and subsequent sedimentation predates and likely will postdate man. Similarly, addition of organic materials to the Bay is a natural process that is in part responsible for the rich population of beneficial organisms in the Bay.

There is a vast difference, however, between natural rates of sedimentation and those existing today; and between natural runoff that bears life-giving levels of nutri-

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ents and massive discharges that suffocate or expel higher forms of aquatic life.

The title assigned to this discussion implies that emphasis is to be given to problems rather than solutions. For this I am grateful, since it makes for an easier and safer task. However, it is not possible to separate the two cleanly, particularly since some of today's problems were yesterday's solutions.

To complete this prologue, I will make one more general remark. Attitudes toward wastes handling can be put in three general categories, labeled: discard, control, and manage. There has been an uneven but rapid evolution from the first to the last in recent years. As we go through a discussion of the unpleasant assortment of pollutants that comprise my topic, some examples will be given of this evolution and an attempt will be made to assess its significance.

Liquid Wastes

Sanitary sewage and industrial liquid wastes are the classic villains. Recently, they have been upstaged at times by such Johnny-come-latelies as heavy metals and thermal effects, but as sustained, publicly accepted threats, they have no equal.

The Chesapeake Bay drainage area is populated by about 10 million people, and this figure may double by the turn of the century. It would seem, therefore, that in order to hold the line at present water quality levels, we will in the future need to do twice as effective a job of liquid waste treatment as we are presently doing. Doubling the effectiveness of any kind of process is usually considered a substantial accomplishment. In this instance, such an approach would be naive. For one thing, doing no better than simply maintaining present water quality levels would hardly be a worthwhile accomplishment. For another, treatment processes commonly employed today are rather selective. For example, the performance of sewage treatment plants is usually stated as the percentage removal of oxygen demanding substances or BOD. By this measure, performance could be improved without reducing levels of phosphates and nitrogen—nutrients whose pollution potential is causing increasing concern.

Another complication is the changing value of liquid wastes. Today, with few exceptions, they are considered to have a negative economic value. However, as effluents of higher and higher quality are produced, coupled with increasing demands for water for potable, industrial, agricultural, and recreational purposes, it will become increasingly desirable and ultimately essential to reuse rather than discharge. Some types of reuse—drinking water is an obvious example—will require extremely high, and therefore expensive, levels of pollution reduction and reliability. Agricultural use, on the other hand, may require less expensive treatment than would direct discharge to a stream.

The handling of liquid wastes offers a good example of the previously mentioned evolution from discard through control to management. The time has long passed when the simple discharge of raw wastes to the nearest stream was considered acceptable. Such discharges from municipalities and industries were once the most serious pollutant in many tributaries of the Bay. The great acceleration in sewage treatment plant construction that took place during the past decade eliminated most of these. The major problems that remain are in the metropolitan areas of Washington and Baltimore. Barring an inconceivable backing-off from present projects and commitments, these problems will be eliminated and point source raw waste discharges need not be considered a long-range threat to the Bay or its tributaries.

Of more concern is the impact of controlled discharges—controlled both in the sense of receiving treatment before discharge and in the sense of being regulated by government. Although sewage treatment is not a new art, and some communities to their credit, built plants back in the days when polluted water and smoking stacks were viewed as symbols of economic progress, it is only recently that pollution control measures have kept pace with the growth of pollution generation. In Maryland, for example, it was not until 1968 that a chronological plot of sewage treatment plant capacity began to parallel and then approach a similar plot of sewage generated.

The effort to provide adequate treatment capacity is obviously not over. It will never be over so long as population and per capita waste generation continue to grow. But, at least, the trend is in the right direction and the quantitative battle appears to be in good shape. The effort to provide adequate quality of treatment is less clear. It is rather unsettling to look at the history of sewage treatment. At one time, simply achieving an adequate volumetric ratio between receiving water and raw sewage discharged was considered adequate, leading to the old adage, "Dilution is the solution to pollution." Then, plain sedimentation, or primary treatment, became the accepted minimum. More recently so-called secondary treatment, using biological processes to remove additional fractions of the pollutants, was set as the goal.

Now there is much discussion of further steps, usually, if vaguely, referred to as tertiary or advanced waste treatment. These terms are sometimes employed to refer to processes which are meant to improve the BOD or solids removal performance of a standard secondary plant, but they are more specifically used to designate nutrient removal facilities.

Few matters are more important to future protection of Bay quality than resolution of the questions concerning critical levels of nutrients in the Bay. The Chesapeake Bay is already rich biologically. Although over-enrichment does not appear to be an immediate problem in the Bay proper, it has occurred in tributaries such as the Potomac Estuary and Back River. Both of these bodies of water are in effect helping to protect the Bay, but at severe cost to their own quality.

The decision has already been made to include nitrogen and phosphate reduction at the Blue Plains Sewage Treatment Plant serving the District of Columbia and areas of suburban Maryland and Virginia. The extent to which such action will be required elsewhere has not yet been determined. The Maryland Department of Natural Resources has appointed a committee to review existing water quality standards and recommend changes in them where needed. A special subcommittee has been charged with examining the issue of nutrients.

Another important issue is reliability. As the performance of treatment plants improve, there is a commensurate need for consistency in that performance. High performance means high water quality that will support the more demanding and valuable forms of aquatic life and permit recreational uses. Even a fairly short period of bypassing, or discharge of poorly treated wastes, will have serious consequences in such waters.

Reliability will impose additional costs in construction, monitoring, and operation. This, coupled with increased costs brought about by the need for more effective treatment plants, will give increased emphasis to cost-effectiveness considerations. This is already becoming evident in the administration of the Federal and State grant programs. Although this is hardly the time to cut back on expenditures for pollution abatement, it is the time to make certain that the maximum water quality is purchased with the money available.

Surface Runoff

Similar in pollutional effects to domestic sewage and industrial wastes, but far different in its susceptability to control land runoff, urban runoff is a serious problem now and is likely to remain one for some time to come. The first increment of rain that flushes city streets, alleys, and yards has chemical and bacteriological characteristics not too different from those of raw sewage. Unlike raw sewage, however, it is not conveyed to a treatment plant prior to discharge but piped to a nearby stream along with the cleaner runoff that follows the initial flush.

Whether urban runoff can be considered a long-range threat to the Bay is problematical, but it clearly contributes to local water quality degradation. As cleaner water results from improved handling and treatment of sewage and industrial wastes, urban runoff will become proportionately more important. It may well become the limiting factor in attaining water quality.

The major problem with urban runoff is, of course, its volume. A system of pipes and other structures adequate to convey the runoff from a good-sized rainfall in a large city to one or even several treatment plants would be of staggering proportions. The plants, too, would be huge even though they would stand idle most of the time.

Several possible approaches are being explored, including storage followed by controlled release and treatment, treatment of the first flush only, and filtration at each storm water outlet. Near-future prospects for effective solutions are not bright.

Agricultural runoff poses many of the same problems, with the additional one that it is even less controlled; reaching watercourses through a diffuse array of trickles, rivulets, and ditches.

Fortunately, this area has not had to contend with the proliferation of huge feed lots that have seriously polluted streams in some other parts of the country. However, we have problems enough. On some streams agricultural runoff is an important source of bacteriological pollution and may be a significant source of nutrients. Like its city sister, agricultural runoff will increase in importance as the treatment of municipal and industrial wastes improves. Again, near future prospects for adequate control are not bright.

Urban and agricultural runoff have one other commonality. The best place to control pollution is at the source. In the city, this means improved solid wastes storage and collection. On the farm, it means improved methods of applying agricultural chemicals and managing livestock.

Sediment

To those who like to measure, photograph, and otherwise record pollutional effects, few pollutants are as obliging as sediment. Although, as mentioned earlier, sedimentation is a natural process, that process has been accelerated greatly by man and his activities. Forested land that may have lost 100 tons/mi^2/yr or less will lose several times as much when cleared for farming, and even more, though for a briefer period of time, when cleared for a construction project.

Some colonial ports in the Bay area can be reached now only by a flat bottom skiff or, in some aggravated instances, by a pedestrian. Other ports have not suffered this indignity because of frequent dredging. The Bay and most of its tidal estuaries are already quite shallow. They can ill afford rapid siltation.

Sedimentation is one pollutant which can be adequately controlled only at its source. Effective measures have barely begun, but new legislation such as that enacted recently in Maryland should permit substantial progress for the first time.

Some forms of pollution are of such magnitude and complexity that the individual citizen may feel he is powerless to make any significant contribution to their solution. This is not true of sediment. Anyone who owns or controls a piece of land can make a contribution. In fact, that is just about the only way the job can be done. Sediment control does not lend itself to radical technological breakthroughs or heroic single-shot solutions. Willing and knowledgable cooperation of many people will be required.

This leads to my final thought. Only in recent years has the magnitude of the pollution control effort begun to approach the magnitude of the pollution problem. It is hardly a coincidence that also only in recent years has there been a widespread expression of public concern over environmental control.

It was not until a few years ago that man discovered that he was not only surrounded by but was in fact part of the environment. The courtship between man and his newly found enviornment saw the strengthening of pollution control laws and budgets. The further discovery of ecology convinced man that he had better marry the environment before she gave her favors to a more prudent species.

Today, it seems, the excitement of the honeymoon is nearing an end, but the prospects for a stable and mutually rewarding marriage appear good. If so, the prospects for the Chesapeake Bay are also good; but should man become again inattentive and apathetic, the prospects for the Bay will be very dim. That may not make much difference to man though, for if impregnable apathy is to be his way of life, his prospects are also dim.

Questions and Answers

The Fate of the Chesapeake Bay: Major Threats

Moderator: **Dr. Ruth Patrick,** *Academy of Natural Sciences of Philadelphia*

Panelists: **Col. W.J. Love,** *Retired*
Dr. Gerald Walsh, *Environmental Protection Agency*
Dr. Michael Bender, *Virginia Institute of Marine Science*
Mr. Thomas McKewen, *Maryland Environmental Service*

Q–In the rivers oyster-metals study, was anything else analyzed–for example, hydrocarbon residues or herbicide residues?

DR. BENDER–No, just those elements we particularly mentioned. We did analyze for mercury but did not find those kinds of relationships. We have, however, a contract with Gulf-Breeze Labs for monitoring pesticides in 10 locations, and we have monitored for polychlorinated biphenyls and DDT since 1968. In the southern branch of the Elizabeth we find the highest levels of polychlorinated biphenyls reaching a peak at about 2½ parts/million in the oysters. The DDT levels are quite low in at least the lower portion of the Bay that we are monitoring. I don't believe we ever found a total residue higher than 0.2 part/million in the past. In localized instances on the Eastern Shore, when spraying operations occur, higher levels occur in crabs and in oysters.

Q–In your talk you made no mention of the hydrodynamic effects of the enlarging of the Chesapeake Bay-Delaware Canal. Can you say something about that?

COL. LOVE–Not too much. There will be effects of net transfers between the Chesapeake Bay and the Delaware Bay. These are under study now and have been under study for some time, but I don't know if reports have been made on them.

Q–Do you feel the Corps of Engineers should change the percentage of various land forms in Chesapeake Bay? If so, which type should be increased and which decreased?

COL. LOVE–I don't think the Corps of Engineers should change too many land forms. If the question were, "Should land forms be changed in the Chesapeake?" I would say as little as possible.

Q–Do the figures, amounts, and dollars on herbicides include employment by military in Viet Nam?

DR. WALSH–The amount used in Viet Nam is a drop in the bucket. With cessation of the use of herbicides in Viet Nam there is no change expected in the economy of pesticides in this country.

Q–Has there been any case of contamination of drinking water with pesticides in which standard water treatment practice has failed to remove them?

DR. WALSH–In 1964 the U.S. Public Health Service reported the presence of dieldrin and endrin in the municipal water of